

This invention relates to building floors; walls, roofs and other parts of buildings in slab form; and more particularly to a product combining the strength and other desirable characteristics of commercially available flanged interlocking building panels of steel, with spot-welded ends and with a core of lightweight concrete made of specified proportions of its constituents be especially adapted to form floors, walls and other structural units or members of residences and homes, as distinguished from multi-storey buildings and other structures of great weight and stress.

PRIOR ART

10 The combination of sheet metal deck sections or forms with concrete in forming floors, roofs and other horizontal structural members is widely used in multi-storey building construction.

It is also well known that there are two successful phenomena which are primarily responsible for the successful use of permanent steel forms or panels with concrete jointly to form structural units. The first is that their co-efficients of expansion are almost equal, thus preventing undesirable internal stresses; and, secondly, when the concrete hardens, it grips the steel thus permitting stress action between the two materials; the result of this joint action being exhibited as the strength
20 of the structural member to resist the imposed load.

Heretofore, however, this combination of steel panels and concrete has not been suitable for use in construction of homes. The tremendous costs, strengths, weights, and unworkability of the standard weight concrete core are uneconomical and unnecessary for the relatively light dead and live loads and strains encountered in the building of homes.

Steel building panels used alone (i.e. not in combination with concrete) such as those which are manufactured by most of the steel companies under various trade names, such as

ARMCO, Butler, etc. have been similarly limited to non-residential buildings, such as warehouses, light aircraft, hangers, storage bins, manufacturing plants and similar low contour type buildings of only one or two floors. Some types of steel panels are also used for "hanging wall" construction.

10 However, such panels have not proved adaptable to the construction of homes or residences because they are prone to vibration, heat and noise conductivity, damage by compressive stresses and bending stresses and condensation, and also because of the difficulty in affixing insulation, plumbing, wiring, nails and other conventional construction materials to them. The necessity of a structural steel framework is also an inhibiting factor.

It is also found that the metal panels or forms (whether used alone or in combination with ordinary concrete) prevent tradesmen, such as carpenters, electricians and plumbers, normally employed in residential housing construction, from exercising their trades in the customary way in mass produced residential housing. This is because it is not economically feasible for such tradesmen to bore through or along the standard weight concrete.

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THE PRESENT INVENTION

The main object of this invention is to combine a light-weight concrete core in specified proportions of water, Canadian portland cement and light-weight insulating cellular material (such as vermiculite, zonolite, or the like) with a flanged interlocking metal building panel combined with metal edges at each end of the panel, spot-welded to the panel, thus overcoming the disadvantage of metal building panels when used alone, or in combination with standard weight concrete. The proportions of the elements of the mixture that constitutes the core, that will have the required qualities, are 72 to 80 gallons of water, 80 pounds

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of Canadian portland cement and 30 pounds of the expanded mineral material.

I have found that the use of light-weight insulating aggregates (such as expanded mica) as the base for this light-weight concrete core eliminates most of the disadvantages of metal panels when used in home building.

In its more desirable form, the light-weight concrete so used contains a sufficiently high percentage of light-

weight aggregate to enable the largely exposed concrete core to be glued, sawed, channelled, chipped into grooves, nailed and worked and dealt with in similar ways in the interior finishing of the home.

The light-weight concrete core of the panel is workable with ordinary hand tools, provides resistance to transmission of heat and noises, and dampens vibration. It is odourless, is unattractive to vermin and is resistant to rot.

10 Such light-weight concrete, used alone without a metal panel will carry quite heavy compressive stresses in relation to home use, but it has almost no resistance to transverse loads and any attempt to impose tensile stresses of appreciable magnitude (even those light stresses associated with use by a family) can result in rupture and consequent failure. Also, it is easily chipped, broken or otherwise damaged and absorbs moisture from the elements if not faced with a waterproof surface.

20 The metal panel combined with edges at each end, spot welded to the panels solves these difficulties by protecting the core against damage and moisture and by adding its resistance to transverse loads and tensile stresses.

The resulting member is sufficiently strong to eliminate the necessity for steel or other structural framework in the building.

The light-weight concrete and metal panel is easy to assemble, workable, and relatively light weight.

Although weaker than standard weight concrete, its strength is sufficient for the requirements with respect to stresses and strains in home building which are relatively slight compared to those required in multi-storey construction.

30 Commercially available metal building panels usually provide for interlocking by means of a male lip or flange

along one side of the panel and a female lip or flange along the opposite side edge of the panel. The male lip of one panel is engageable with the female lip of the adjacent panel so that several sections can be assembled in a side-by-side (or spot-welded end-to-end) relationship to form a larger structural unit. After the individual panels are thus assembled into a structural unit or member, the female lips are crimped in some cases to become tightly bonded with the male lips of the adjacent section.

- 10 Types of panels where this lip or flange (or other configuration of the panel) is suitable for gripping or enclosing light-weight concrete if it is poured into the core of the panel are susceptible of being used in this invention.

Various gauges of steel and widths of sections are available commercially. These latter variances will govern the characteristics of strength, insulation, sound-proofing which may also be varied by varying the type of light-weight aggregate used to make the light-weight concrete.

- 20 These and other objects and advantages of the present invention will become apparent from the following detailed description by reference to the accompanying drawings in which spot-welded ends edges are not shown) in which:

Figure 1 - is a perspective illustration of an individual interlocking flanged metal building panel prior to assembly into a structural building unit or member.

Figure 2 - is a perspective illustration of a structural building member comprised of interlocking panels prior to being filled with light-weight concrete.

- 30 Figure 3 - is a perspective illustration partly broken away of a typical floor or roof unit according to the present invention.

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Figure 4 - is a perspective illustration of a fragment of a wall unit where the open part of the core is covered by asbestos board panels affixed with metal screws onto the metal panel prior to pouring of the concrete.

The flange or lip¹ of the steel building panel shown in Figure 1 grips and partially encloses the concrete core, 2 which in turn causes a resistance to flex to inhibit any twisting, bulging, bending, buckling or denting, or other tendencies towards weakness of the metal building section in its ordinary state.

The steel section provides a form for the pouring of the light-weight concrete 2 and also acts to reinforce the concrete, besides acting as a waterproofed permanently painted exterior.

10 When the invention is used for flooring a roof, as in Figure 3 and 4, the steel is first set up and interlocked as in Figure 2. The ends are then blocked and the cores of the interlocked panels are filled with concrete.

When the panels are used as walls, as in Figure 4, plywood or asbestos board 5 can be attached with screws⁶ or glued to fill in the interior side of the panel thus making a vertical form which is filled with the concrete; or the panel can be poured as in a floor-type panel and erected when the cores have hardened by a light crane, winch, back-hoe boom or similar
20 lifting device.

For example, the commercially available "ARMCO" metal panel has a male and female flange shaped in such a manner that when assembled into a structural unit, each panel forms a trough with an overhanging lip which would grip and partially enclose the light-weight concrete poured into the trough of the panel.

Each channeled metal ARMCO panel protects the core

against damage and moisture. The concrete core becomes an integral unit with the steel panel so that stress action is permitted between the two materials to increase the metal's resistance to compression and bending stresses.

10 I have found, for example, that the poring of light-weight concrete into the trough of an "ARMCO" type building panel increases the strength up to three hundred and fifty percent (350%) according to tests conducted at recognized public testing facilities. Spans of floors and roofs of up to sixteen feet (16') are possible using members comprised of panels using this invention.

The structural unit has a smooth surface on both sides. The metal exterior is already primed, painted and weather-proofed as part of the manufacturing process of the metal panel. The interior of exposed light-weight concrete is ready for plastering, panelling or other interior finishing.

20 When used as a floor member, the exposed light-weight concrete core of the panel (or unit comprised of panels) provides a suitable underlay for flooring as well as for walls and ceilings.

CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed as follows:-

1. In combination, a slab-type structural building unit comprising metal panels, channel-shaped horizontally, each such panel having a male inwardly and downwardly projecting flange formed on one edge of the panel, and on the opposite edge a female outwardly and downwardly projecting flange, the said male and female flanges being shaped to interlock with the corresponding male and female projecting flanges in adjacent metal panels laid parallel to the flanges; vertical ends substantially equal in height to the flanges, spot-welded to the ends of the panel; a light-weight core or aggregate between the channels of the panel, composed of a mixture of water, Canadian portland cement and expanded mineral material (such as zonolite or vermiculite or the like) in the proportions of between 71 and 80 gallons of water, 80 pounds of Canadian portland cement and 30 pounds of the expanded mineral material.
2. A building, the walls, floors and ceilings of which consist of the units shown in claim 1.

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ABSTRACT OF THE DISCLOSURE

This invention relates to building panels made by filling flanged interlocking building panels with light-weight concrete, in such a way as to form floors, walls, and other parts of buildings.

The utility of the invention is primarily to permit the use of steel building panels, and concrete (in light-weight form) in residential buildings. The light-weight concrete provides sufficient strength for the relatively light loads involved in residential buildings, and provides resistance to transmission of heat and noise, and damps vibration. It is also odorless, anti-vermin, and resistant to rot. The light-weight concrete is sufficiently workable to be glued, sawed, channelled, screwed and nailed.

The combination with the metal building panel permits a permanent paint or enamelled surface, and the steel building panels act both as a form for the concrete, and a permanent part of the structure.

20 The use of steel panels with ordinary concrete is well known, but has hitherto been inapplicable to residential buildings because of the unworkability of normal concrete, its weight, and expense. However, even normal-weight concrete is not usually used in combination with interlocking metal building panels, such as are used for light one-storey type buildings.

The combination of the readily available and cheap building panel, with the low cost of light-weight concrete, and the relative strength related to weight and thickness should provide for a low cost strong and permanent method of making floors, walls, and roofs for residences.

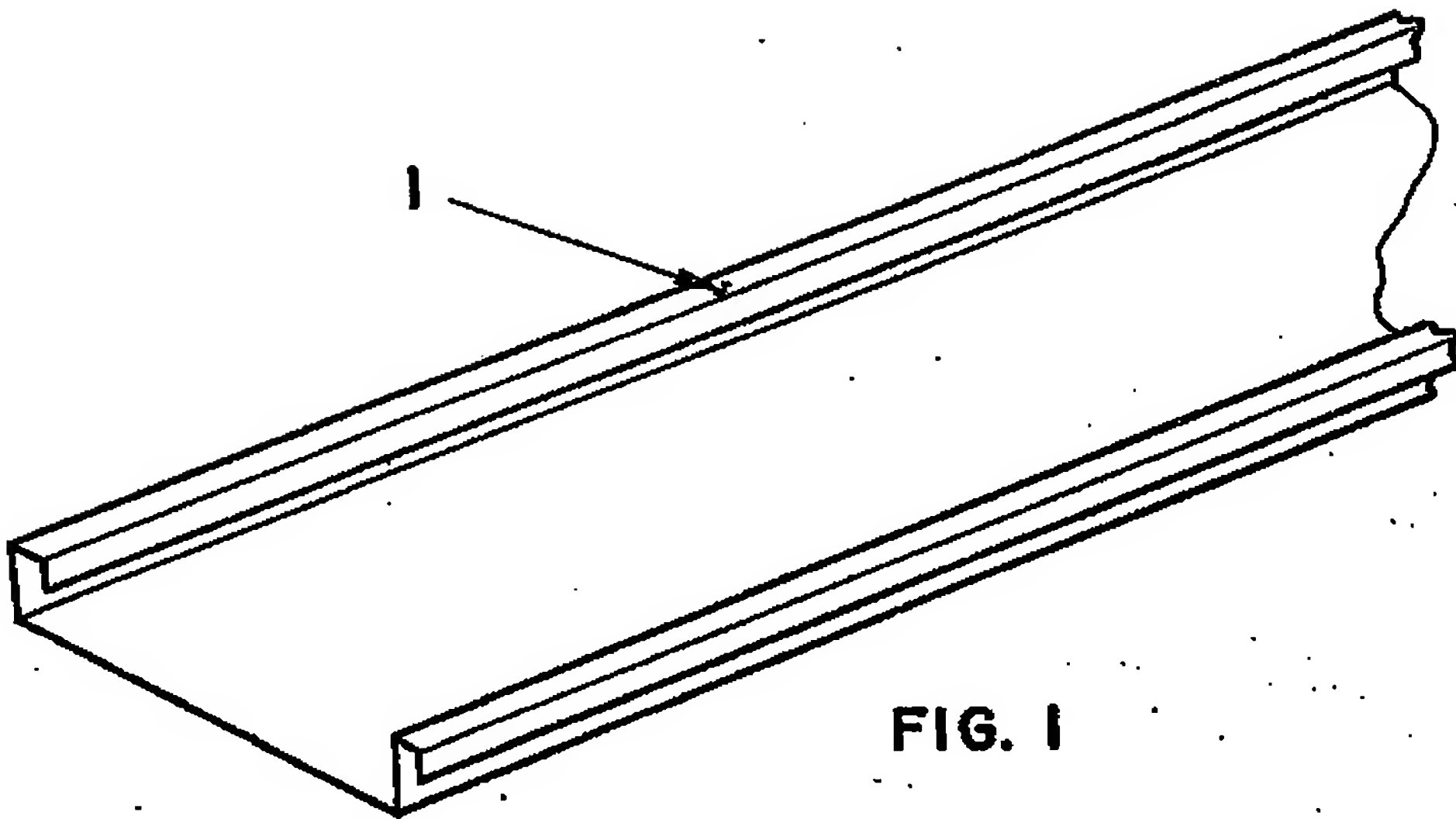


FIG. 1

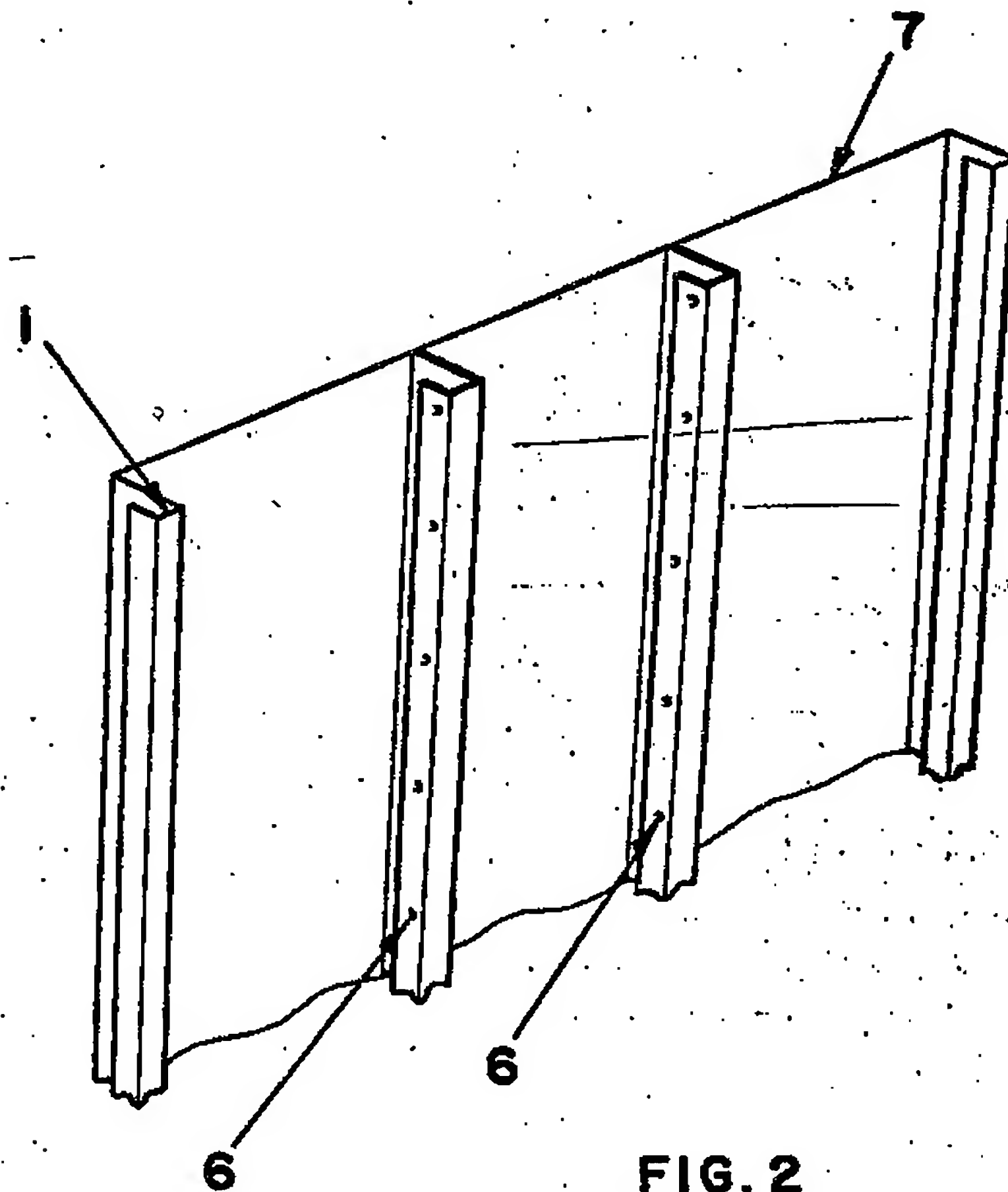


FIG. 2

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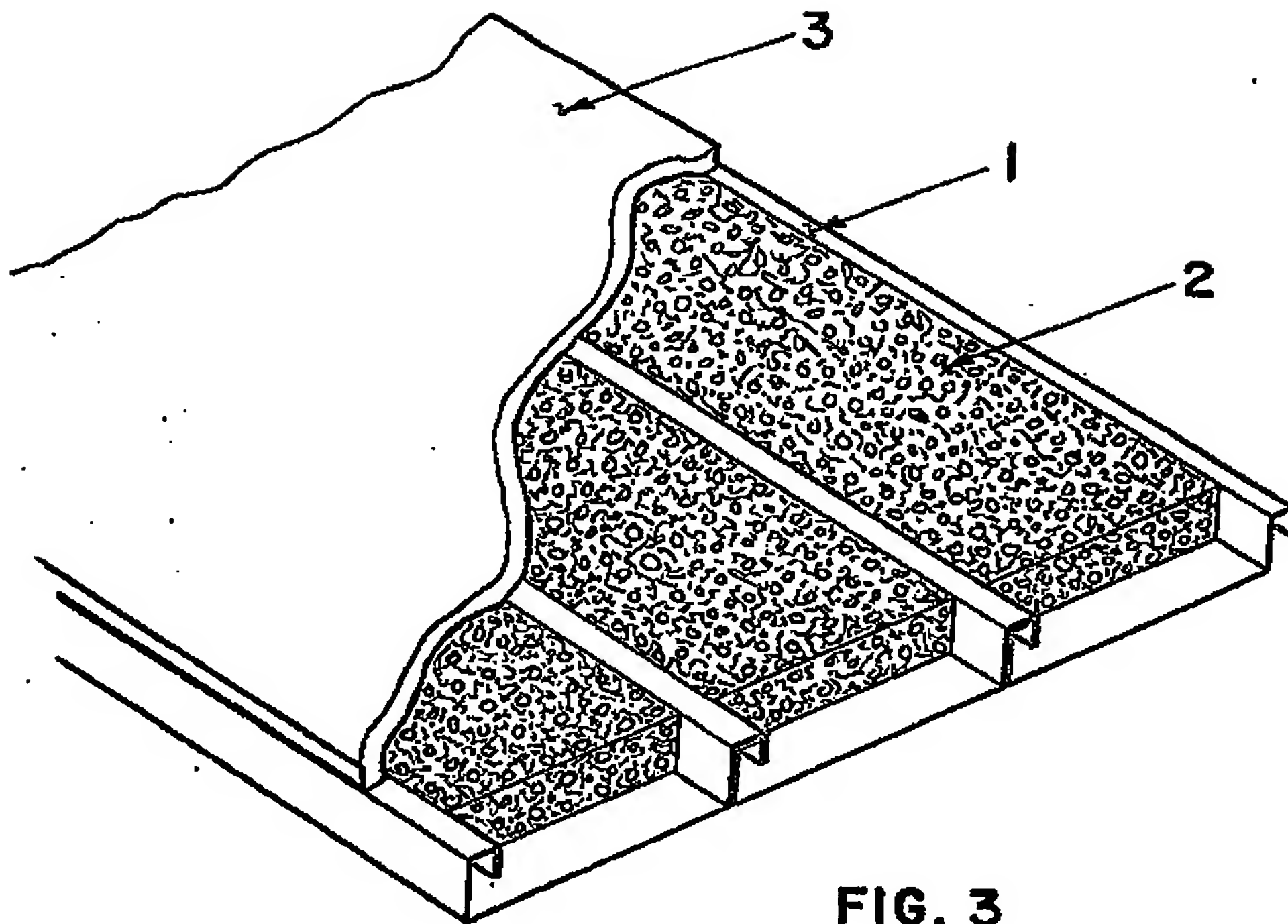


FIG. 3

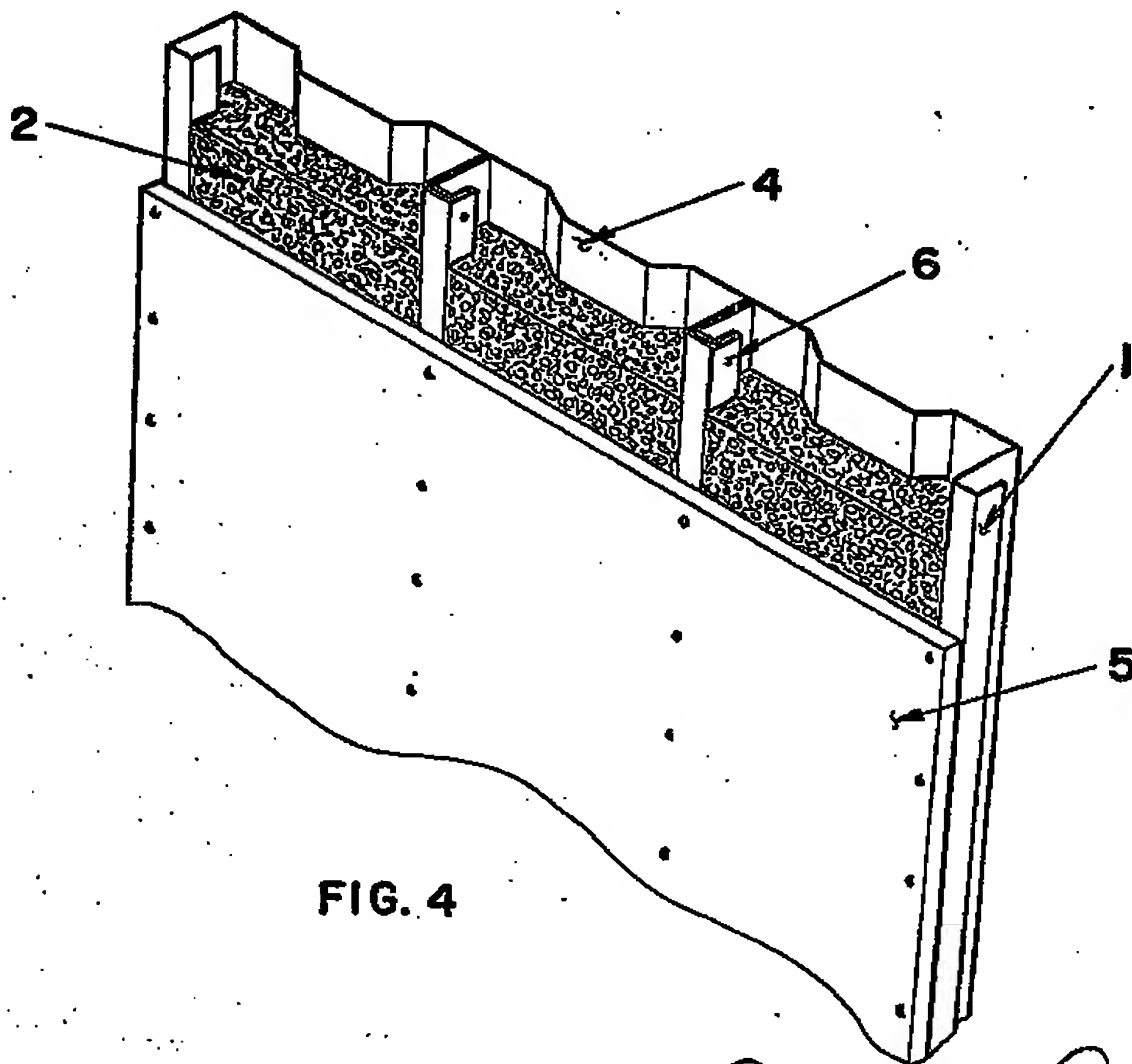


FIG. 4

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